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Using Flash Animations and 3D Rendering to Increase the Effectiveness of Instructional Software

Timothy A. Philpot

Missouri University of Science and Technology, philpott@mst.edu

USING FLASH ANIMATIONS AND 3D RENDERING TO INCREASE THE EFFECTIVENESS OF INSTRUCTIONAL SOFTWARE

Timothy A. Philpot[1]

Abstract *— Animation and three-dimensional rendering software offers exciting new capabilities that can enhance engineering instructional material. Using these software tools, instructional media can escape the static two-dimensional confines of the printed page or the classroom blackboard. This work-in-progress will describe a project to develop instructional material for the Mechanics of Materials course. The paper will present examples of instructional animations, discuss software development tools used to create the animations, and discuss early student reaction to the multimedia presentations.*

Index Terms — animation, instructional software, Macromedia Flash, three-dimensional rendering

INTRODUCTION

In the Mechanics of Materials course, students study various types of structural components, learning techniques for solving common engineering problems associated with each type of component. Computer-based instruction offers new capabilities that can enhance the student's understanding of the Mechanics of Materials concepts. With 3d rendering software, it is possible to create photo-realistic images of various components and to easily show these components from various viewpoints. Animation software allows objects or processes to be shown in motion. By combining these two capabilities, a fuller description of a physical object can be presented to the student. Better images can facilitate the mental visualization that is so necessary to understanding and solving engineering problems in this subject area.

PROTOTYPE INSTRUCTIONAL MODULES

Several types of instructional animations are being developed for the Mechanics of Materials course. The goal for each type of module is to present the course concepts and skills in a way that students can more readily understand and apply in typical contexts. Examples of each type are given below:

- Fundamental Concepts – Students typically have difficulty in visualizing how components fail; therefore, a number of simple animations have been developed to illustrate the various ways that common components break. Through animation, the failure surfaces in the material become readily apparent.
- Derivations – One example of this type of animation involves pressure vessels. Since pressure vessels are three-dimensional, the necessary free-body diagrams become much easier to understand if 3d rendering software is utilized.
- Advanced Concepts – Principal stress calculations involving combined axial, torsion, bending, and shear stresses are always difficult to explain to students because it is difficult to adequately show the configuration of the object and its three-dimensional loads. 3d rendering allows a single model to be constructed that the student can rotate as desired in order to understand the relationship between each load and the type of stress it produces.
- Calculation Procedures – Animation and 3d rendering can also provide clearer step-by-step explanations of the problem-solving method by selectively highlighting portions of the physical object being considered as the associated calculation is constructed.

SOFTWARE DEVELOPMENT TOOLS

Macromedia Flash is the predominant software for animated content delivered via the Internet. Flash produces high quality, scalable vector graphics that can be delivered in a small file size. There are a number of 3d rendering programs (most notably Kinetix 3ds max and Maxon Cinema 4D) that can be used for modeling and animation. Highly detailed scenes can be animated with this type of software; however, file sizes quickly become large making Internet-delivery difficult. Electric Rain's Swift 3D is a type of hybrid software that produces 3d renderings directly in the Flash .swf file format, thus enabling moderately detailed scenes to be produced while keeping file sizes small.

EARLY STUDENT REACTION

As they became available during the 2001 Spring Semester, instructional modules were tested in a class of thirty Mechanics of Materials students. Roughly one-third of these students indicated a strong approval and interest in the new media while only one or two students were outspokenly negative. Computer-based instructional media should not be touted as a panacea; however, a significant number of students do seem to respond positively to the new approaches. In general, animation and 3d-enhanced instructional media offer excellent supplements to the professor during lecture periods, and when combined with Internet-delivery, they can provide students with effective self-study tools.

[1] Timothy A. Philpot, University of Missouri - Rolla, Department of Basic Engineering, Rolla, MO 65409-0210 philpott@umr.edu

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